Research Paper | Biochemistry | E-ISSN No : 2454-9916 | Volume : 3 | Issue : 12 | Dec 2017

VITAMIN D ASSESSMENT IN HEALTHY VOLUNTEERS IN RELATION WITH SKIN COLOR, SUN EXPOSURE

Rajinder Prasad [1] | Suvarna Prasad [2]

[1] PhD Scholar, Department of Biochemistry, Maharishi Markandeshwar Institute of Medical Sciences and Research, Mullana, Ambala, Haryana, India.

[2] Professor and Head, Department of Biochemistry, Maharishi Markandeshwar Institute of Medical Sciences and Research, Mullana, Ambala, Haryana, India.

ABSTRACT

Vitamin D is a fat-soluble vitamin that is converted to a hormone within the body itself. Skin is the only organ where both cholesterol and vitamin D3 are synthesized. By definition, hormones are considered to be chemical messengers that relay messages to cells. Hormones cause cells to express specific sequences of deoxyribonucleic acid (DNA), which is contained within the cell nucleus. Vitamin D is mainly produced during exposure to sunlight; UV-B photos (290-315 nm) penetrate skin where they are absorbed by 7-dehydrocholesterol (7-DHC). The present study was planned to "Assessment of vitamin D status in healthy volunteers and to correlate levels of vitamin D in relation with skin color and sun-exposure. The study was conducted in the Department of Biochemistry, M. M. Institute of Medical Sciences and Research, Mullana, Ambala (Haryana). The study population two hundred (200) healthy volunteers were derived from employees and students aged 20-60 years of either sex. In our study 57.5% of total subjects had vitamin D deficiency. The subjects used to daily sun light exposure were 71(35.5%) out of 200, among 71 there was 61(71.8%) had normal vitamin D and in 10(8.7%) had abnormal level of vitamin D had low prevalence as compare to other subjects who got, less amount of sun light exposure and the association of vitamin D level was found statistically highly significant (p=0.000) with sun light exposure and also found that the association of vitamin D level was found statistically highly significant (p=0.000) with skin color of all study subjects

KEY WORDS: Vitamin D, sun-exposure, skin color.

INTRODUCTION:

Vitamin D is not a single entity but a group of anti-rachitic substances that are found in certain foods as well as synthesized in skin as figure 1.

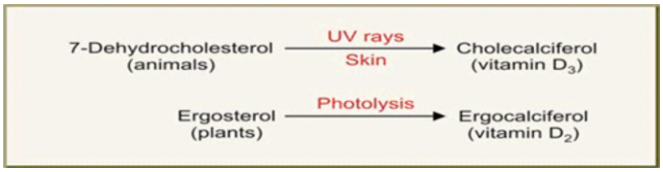

Figure 1: Activation of vitamin D from 7-dehydrocholesterol

Vitamin D is a generic term for vitamin D2 (ergocalciferol), vitamin D3 (cholecalciferol), and their metabolites (1). Vitamin D2 is derived from the yeast and plant sterol, ergosterol and is the form widely used in pharmaceutical preparations. Vitamin D3 is mainly produced during exposure to sunlight; UV-B photos (290-315 nm) penetrate skin where they are absorbed by 7-dehydrocholesterol (7-DHC). The absorption of UV-B radiation causes 7-DHC, a steroid, to open its B ring, forming precholecalciferol (pre-D3). Pre D3 undergoes rearrangement of its double bonds to form vitamin D3 (2). Vitamin D is metabolized in the liver to 25-hydroxyvitamin D [25(OH)D], which is the major circulating and storage form that is delivered to tissues for further activation. Some 25(OH) D is converted in the kidney to a biologically active hormonal form, 1, 25-dihydroxyvitamin D [1,25$(OH)_2$D]. A variety of factors, including serum phosphorus and parathyroid hormone (PTH), regulate the renal production of 1, 25 $(OH)_2$D. The 1, 25 $(OH)_2$D regulates calcium metabolism through its interaction with the major target tissues, the bone and the intestine (2). Beside the small intestine and the osteoblast, vitamin D receptor (VDR) for 1,25 $(OH)_2$D has been identified in brain, heart, skin, pancreas, breast, colon, and immune cells. The 1, 25 $(OH)_2$D helps regulate cell growth and maturation, stimulates insulin secretion, inhibits renin production, and modulates the functions of activated T and B lymphocytes and macrophages (3,4,5). Thus 1, 25 $(OH)_2$D has also other important functions in addition to calcium homeostasis.

Factors related to decreased sun exposure affect skin production of vitamin D, which is the major source of vitamin D for most humans (6). The available UV-B for vitamin D synthesis is greatly decreased in the winter season and the high latitude regions. Skin pigmentation genetically affects vitamin D production in the skin as melanin is a natural sunscreen. Since very little vitamin D is naturally present in foods, vitamin D deficiency is common because in situations when skin production is compromised, dietary vitamin D intake cannot meet the compensatory requirement. It has been found that even in countries with mandatory staple food fortification, vitamin D intakes are low in some groups due to their unique dietary patterns, such as low milk consumption, vegetarian diet, and limited use of dietary supplements etc (7).

MATERIALS AND METHODS:

The present study was conducted in the Department of Biochemistry, Maharishi Markandeshwar Institute of Medical Sciences and Research (MMIMSR), Mullana, Ambala, (Haryana) over a period of 12 months. The study population was derived from employees and students aged 20-60 years of either sex who are willing to participate. A total of two hundred (200) healthy volunteers aged 20-60 years of either sex. An informed written consent and detailed history about sun-exposure and skin color of all the subjects was taken.

Inclusion criteria:

- Age: 20 years to 60 years.
- The subject has to be apparently healthy and residing in Haryana.

Exclusion criteria:

- Any suggestion of liver, kidney or gastrointestinal disease.
- Any skin diseases.

Methodology:

Blood samples were collected by standard venepuncture method.

Investigation:

Serum vitamin D assayed in clinical biochemistry lab by direct competitive chemiluminescence immunoassay (CLIA) (8).

Vitamin D reference range in serum 30-100 ng/ml was taken.

RESULTS AND DISCUSSION:

In our study 57.5% of total subjects had vitamin D deficiency. The subjects used to daily sun light exposure were 71(35.5%) out of 200, among 71 there was 61(71.8%) had normal vitamin D and in 10(8.7%) had abnormal level of vitamin D had low prevalence as compare to other subjects who got, less amount of sun light exposure and the association of vitamin D level was found statistically highly significant (p=0.000) with sun light exposure as shown in the table number 1 and figure 2.

Table 1: Distribution of study subjects by vitamin D level and sun light exposure

Sun light exposure	Vitamin D						χ^2 (df)	p Value
	Normal		Abnormal		Total			
	No.	%	No.	%	No.	%		
Used to daily	61	71.8	10	8.7	71	35.5	88.588 (3)	0.000
1-2 tpw	18	21.2	47	40.9	65	32.5		
1-2tpm	6	7.0	55	47.8	61	30.5		
Seldom	--	--	2	1.8	2	1.0		
Total	85	42.5	115	57.5	200	100.0		

tpw=times per week, tpm=times per month

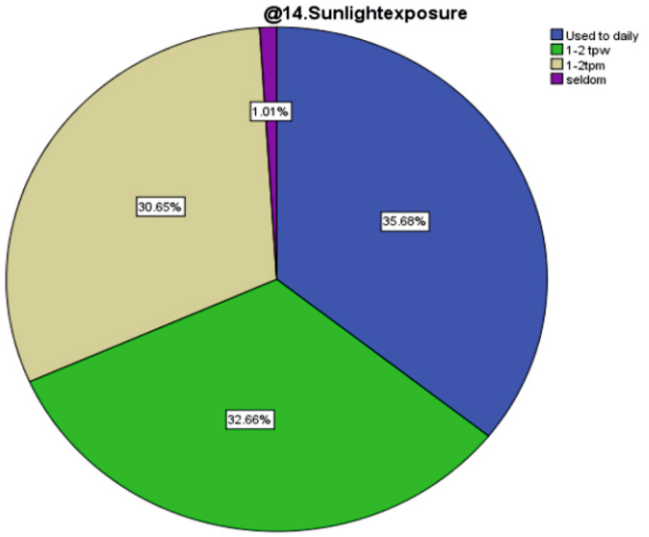

Figure 2 showing the exposure in sun light of all study subjects in percentage.

Similar finding were observed by Gaafar M. and Badr S.; 2013, they found that the daily sun exposure makes an impact on the amount of vitamin D synthesized. Highly significant negative correlation was found between duration of daily sunlight exposure and vitamin D deficiency ($p<0.0001$).

Another, similar findings were observed by. Kiran B et al.; 2014 vitamin D significantly correlated positively with sunlight exposure with correlation coefficient of 0.187 with a p value of 0.001($p=0.001$). Subjects included in present study were working in MM University from 8.30 am to 4 pm. Sun light exposure in these subjects was very limited.

Out of 200 subjects 80(40%) were of brown color, 72(36%) were with light brown and 48(24%) were with dark brown color. During analysis it was found that among 85 subjects (of normal reference range of vitamin D) had 33(38.8%) of brown colour and 52(61.2%) of light and on the other hand 115 subjects (of abnormal reference range of vitamin D) had 47(40.9%) of brown color and 20(17.4%) of light brown color and 48(41.7%) of dark brown color. It was found that dark brown color had more prevalence than light brown color in vitamin D deficiency and also found that the association of vitamin D level was found statistically highly significant ($p=0.000$) with skin color of all study subjects with normal and abnormal reference range of vitamin D as shown in the table number 2.

Table 2: Distribution of study subjects by vitamin D level and skin color

Skin color	Vitamin D						χ^2 (df)	p Value
	Normal		Abnormal		Total			
	No.	%	No.	%	No.	%		
Brown	33	38.8	47	40.9	80	40.0	61.557 (2)	0.000
Light Brown	52	61.2	20	17.4	72	36.0		
Dark Brown	--	--	48	41.7	48	24.0		
Total	85	42.5	115	57.5	200	100.0		

Similar study was conducted by Kiran B et al., 2014 with positive correlation between D vitamin and skin color and dissimilar study conducted in Belgium that the skin pigmentation had negative effect on Vitamin D synthesis subcutaneously by Libon et al., 2013.

Vitamin D deficiency had again become a major public health interest with its association with osteoporosis, osteomalacia, fractures, and more recently with prevention of cancer, diabetes, heart disease and other chronic illnesses. Regular sun exposure has decreased due to changing lifestyles. Vitamin D deficiency is especially prevalent in dark skinned population living in Northern latitudes. Improving the vitamin D status worldwide would have dramatic effects on public health, and reduce healthcare costs for many chronic diseases. The most cost-effective way to remedy this deficiency is to increase food fortification with higher levels of vitamin D along with sensible sun exposure, and adequate vitamin D supplementation.

CONCLUSIONS AND FUTURE PERSPECTIVES:

Vitamin D deficiency is a common complication in these days. The present study suggests that vitamin D decreases with low sun exposure, it is necessary to spent at least 30 minutes per day to meet the optimum amount of vitamin D. Screening for vitamin D on a regular basis may help to identify a subgroup of peoples that are at high risk for bone diseases, cancer, autoimmune diseases and cardiovascular diseases and decreased level also affect the cell metabolism. Early intervention and treatment makes life easy and comfortable for all human being.

REFERENCES:

1. Gibson RS. Principles of nutritional assessment. New York, NY 2005: Oxford University Press, Inc.
2. Holick MF. Vitamin D: a millennium perspective. J Cell Biochem 2003; 88: 296-307.
3. Norman AW. Sunlight, season, skin pigmentation, vitamin D, and 25-hydroxyvitamin D: Integral components of the vitamin D endocrine system. Am J Clin Nutr. 1998; 67: 1108-1110.
4. Deluca HF, Cantorna MT. Vitamin D: its role and uses in immunology. FASEB J. 2001; 15: 2579-2585.
5. Adorini L. 1,25-dihydroxyvitamin D3 analogs as potential therapies in transplantation. Curr Opin Invest Drugs. 2002; 3: 1458-1463.
6. Webb AR, Engelsen O. Calculated ultraviolet exposure levels for a healthy vitamin D status. Photochem Photobiol 2006; 82: 1697-1703.
7. Calvo MS, Whisting SJ, Barton CN, Vitamin D intake: a global perspective of current status. J Nutr. 2005; 135: 310-316.
8. Holick MF. Vitamin D status: Measurement, interpretation, and clinical application. Ann Epidemiol. 2009; 19(2): 73-8.